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<b>(21) International Application Number:</b> PCT/US97/13526 <b>(22) International Filing Date:</b> 25 July 1997 (25.07.97)  <b>(30) Priority Data:</b> 08/687,894      26 July 1996 (26.07.96)      US  <b>(71)(72) Applicant and Inventor:</b> BATEMAN, Kristine, A. [US/US]; 243 West Main Street, Rigby, ID 83442 (US).  <b>(74) Agents:</b> DE GROOT, Robert, A. et al.; Hopkins Roden Crockett Hansen & Hoopes, PLLC, P.O. Box 51219, Idaho Falls, ID 83405-1219 (US).		<b>(81) Designated States:</b> AL, AU, BA, BB, BG, BR, CA, CN, CU, CZ, EE, GE, HU, IL, IS, JP, KE, KP, KR, KZ, LC, LK, LR, LT, LV, MG, MK, MN, MW, MX, NO, NZ, PL, RO, SD, SG, SI, SK, TR, TT, UA, UG, UZ, VN, YU, ZW, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).  <b>Published</b> <i>With international search report.</i>
<b>(54) Title:</b> DIETETIC ONE-TO-ONE SUGAR SUBSTITUTE COMPOSITION FOR TABLE TOP, BAKING AND COOKING APPLI- CATIONS  <b>(57) Abstract</b>  A low calorie, diabetic safe, water soluble, tooth friendly, synergistic sweetening composition containing intense sweeteners; bulk sweeteners; a small amount of simple sugar sweeteners to help with the browning of the baked food products; anti-flatulent agents used to help to break up the gas created as the polysaccharides metabolized by the intestinal microflora; and flavoring agents. The present invention is very stable under processing conditions including heat, pH, and moisture. The composition is a one-to-one substitution for granulated sugars, brown sugars, and powdered sugars. The sweetening composition can be used in all types of "ingestible food". These ingestible foods retain their sweetness, appearance, texture and good taste when compared to food preparations made with regular granulated, brown and powdered sugar.		

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## **DIETETIC ONE-TO-ONE SUGAR SUBSTITUTE COMPOSITION FOR TABLE TOP, BAKING AND COOKING APPLICATIONS**

### **TECHNICAL FIELD**

This application claims priority from U.S. application serial number 08/687,894 filed July 26, 1996, and currently pending with the U.S. Patent Office.

This invention is for one-to-one sugar replacement compositions that can replace granulated sugars, brown sugars and powdered sugars.

### **BACKGROUND OF THE INVENTION**

The need to control weight because of obesity and other health relate problems are well known. Common sugar (sucrose) has four calories per gram and is associated in foods that are typically high in calories. Sugar is probably the most important ingredient in the confectionery and baking industry with fat being a close second. Consumers with endocrine disorders such as diabetes mellitus are advised to follow a strict diet staying away from sugar and to eat low fat. Diabetes is often controlled by a diet, and two aspects are of significant importance: 1) control of intake of carbohydrates influencing the blood glucose and insulin levels, and 2) control of the total calorie intake. In the past, the consumer who had to eat sugar free foods had to limit their diet to include only foods that were naturally low in sugar or to use the intense sweeteners and other sugar sweeteners available in the marketplace. The desire for a diabetic individual to be able to bake, cook and eat foods normally high in sugar such as rich bakery products is well known. However, these rich baked foods have been prohibited because of the high amount of sugar and fat that they contain. A "diabetic safe" sweetener is a sweetening agent that when ingested by a diabetic person does not significantly

1 raise their glucose and insulin levels in the blood. The search for a low calorie, diabetic safe  
2 sugar replacement used in these types of food products has been illusive.

3 Applicant defines the term "ingestible" to include all ingredients and compositions  
4 which are used by or which perform a function in the body. These include ingredients and  
5 compositions which are absorbed and those which are not absorbed as well as those that are  
6 digested and not digested. Applicant defines the term "low calorie" to mean  $\frac{1}{2}$  the calories or  
7 less of the ingestible food it is substituting. The present invention has  $\frac{1}{2}$  the calories or less  
8 of sucrose. "One-to-one" substitution is the term used to replace an ingredient in ingestible  
9 foods with the same amount of another ingredient used to replace it. This substitution is either  
10 in weight measurement or volume measurement--for example, cup for cup, pound for pound,  
11 etc. The term "natural" is meant to mean to exist or caused by nature. Example, an ingredient  
12 can be naturally found in plants. Applicant defines the term "water soluble" to mean the  
13 amount of that particular ingredient that will go into a solution in water and as the temperature  
14 of the water rises, the amount of the ingredient capable of being dissolved in a given amount  
15 of water also increases. "Bulk sweeteners" can include both polysaccharides and  
16 oligosaccharides. "Polysaccharide" is defined as a carbohydrate containing eleven or more  
17 saccharide units joined with the elimination of a molecule of water at each point of linkage.  
18 "Oligosaccharide" is defined as a carbohydrate consisting of two to ten monosaccharides joined  
19 by the elimination of water. It is smaller than a polysaccharide and less prominent in foods.

20 A variety of intense sweeteners have been available to the consumer to be used in  
21 ingestible food compositions. However, the intense sweeteners available have been lacking  
22 in several aspects. First, they have lacked the bulk necessary to substitute in a one-to-one basis  
23 in recipes. If a cup of sugar was taken out of a cake recipe and replaced by a small amount

1 of intense sweetener or at best, partial bulk of the original sugar, the cake simply did not turn  
2 out with a comparable texture, taste, appearance or overall appeal of the regular sugar cake.  
3 In the past the intense sweeteners and bulk sweeteners could only be used successfully if each  
4 ingestible food product was altered and adjusted to compensate for the loss of bulk in a recipe.  
5 The novice cook was unable to do such alterations on every recipe and in all types of foods.  
6 Even in the commercial field today, each recipe has to be adjusted with a variety of bulk  
7 sweeteners and intense sweeteners. Usually the sweeteners, both bulk and intense, are changed  
8 with each type of food or recipe. It is the common practice of making one recipe or food  
9 preparation low calorie. This makes the sweeteners or sweetening compositions very limiting  
10 in their use. There have been no suitable sweetening compositions that could be used in all  
11 types of foods as a complete sugar replacement and under all types of use including table top  
12 use, baking, cooking, and mixing situations.

13 Second, most of the intense sweeteners available lose their sweetness under heat.  
14 Aspartame is a water soluble, dipeptide intense sweetener 200 times sweeter than sugar. It is  
15 a protein made from the natural amino acids L-aspartic acid and L-phenylalanine and is  
16 digested like any other protein and is fully metabolized by the body. Because aspartame's  
17 sweetening power is so intense, only small amounts are needed for most applications. A  
18 similar product has been marketed under the name of Nutritsweet and it states on its label that  
19 it is not recommended to be used under heat and baking conditions, and if possible add the  
20 aspartame after cooking. This intense sweetener is very unstable under heat, pH conditions  
21 (including aldehydes), ketones of cinnamon flavor and moisture. Many patents have been  
22 issued in the pursuit of making this dipeptide sweetener more stable. The encapsulating of  
23 aspartame is one of the more popular versions. In this encapsulation aspartame is usually

1 covered in a wax, fat or other coating after being prepared in several manners. U.S. Patent  
2 No. 5,043,169 is one such aspartame encapsulating patent. This patent is the tableting process  
3 of a composition including aspartame, carbohydrates including polydextrose. Additional  
4 sweeteners may be chosen from the following non-limiting lists: sugars, such as glucose (corn  
5 syrup), sucrose, dextrose, invert sugar, fructose, aspartame, non-fermentable sugar substitutes,  
6 and acesulfame-K. Again the combination of these ingredients is not meant to be a sugar  
7 substitute to be used in baking and cooking. The tendency now is to use aspartame in the  
8 foods and drinks that do not experience the heat, moisture and change of pH. Also, many  
9 times aspartame is added to an ingestible food or drink with other more stable intense and bulk  
10 sweeteners on an individual recipe basis. Public approval seems to be shifting to the negative  
11 perception of the use aspartame. Many consumers claim to stay away from foods containing  
12 it because of the rumors heard. When used in the present invention, the level of aspartame is  
13 kept low because of the synergistic effect between the intense sweeteners and the bulking  
14 sweeteners and agents. The amount used is lower than if used by itself.

15 Acesulfame-K is a known stable intense sweetener that is also 200 times sweeter than  
16 sugar, water soluble, tooth friendly and diabetic safe which has been used in many food  
17 products. It is not metabolized and therefore, non-caloric. It has been known for its strong  
18 bitter taste. U.S. Patent No. 5,106,632 assigned to Warner-Lambert Company discloses an  
19 acesulfame-K containing composition used in sour chewing gum exhibiting enhanced sweetness  
20 having one or more food grade acids, including acesulfame-K and potassium chloride. They  
21 claim the composition can be used in edible food such as a cake, cookie, or other baked  
22 products, but again would have to be adjusted for every recipe because of lack in bulk and  
23 sweetness. In this patent it is definitely not a one-to-one replacement for 100% of the sugar.

1 In U.S. Patent No. 4,382,963, Klose discloses a sugar free, low calorie chewing gum utilizing  
2 spray dried polydextrose as the bulking agent and sweetening with either fructose, aspartame,  
3 sugar alcohols, or acesulfame-K, etc. U.S. Patent No. 4,983,405 is another patent issued in  
4 the goal of making low calorie and sugar free gums using intense sweeteners, bulk sweeteners,  
5 fructose, and glucose (corn syrup), etc. U.S. Patent No. 5,342,631, assigned to Wm. Wrigley  
6 Jr. Co., discloses a patent for use in some petroleum wax-free gums using high intensity  
7 sweeteners represented by, but not limited to sucralose, aspartame, stevioside, acesulfame-K,  
8 alitame, saccharin and its salts, cyclamic acid and its salts, glycyrrhizin, dihydrochalcones,  
9 thaumatin, monellin, and the like. It also includes non-cariogenic oligosaccharides, and  
10 flavors. This patent specifies using these combinations of ingredients in the petroleum wax-  
11 free gum only. U.S. Patent No. 5,098,730 by Tammy Pepper discloses a reduced calorie,  
12 non-carcinogenic sweetener of xylitol and a reduced calorie bulking agent. Acesulfame-K is  
13 listed as a possible intense sweetener that could possibly be added to the invention.  
14 Additionally, several prior patents have disclosed a synergistic action between other groups of  
15 intense sweeteners such as a cesulfame-K. The U.S. Patent No. 4,495,170 provides  
16 synergistic compositions containing a mixture of sweetening agents; the list includes  
17 saccharine, stevioidise, acesulfame-K or other bitter tasting sweetening agents, with at least one  
18 sweet chlorodeoxysugar sweetener selected from the group consisting of chlorodeoxysucrose  
19 and chlorodeoxygalactosucdrose.

20 The criterion of finding natural intense sweeteners is also lacking in the above patents.  
21 The goal of being able to make a natural sweetening composition has been very difficult using  
22 the intense sweeteners on the market. One natural intense sweetener is thaumatin, the sweetest  
23 natural substance known to man, the brand name being Talin. The protein thaumatin is found



1 in the Katemfe plant of *Thaumatococcus Daniellii* grown in the hot humid forests of West  
2 Africa. The formulation with gum arabic helps make it more stable in use with colors, fruit  
3 juices, and with its tendency to interact with xanthin gum, pectin, carboxymethyl cellulose,  
4 carrageenan, guar gum, locust bean gum or alginate under higher temperatures. Prior art  
5 using thaumatin or talin as an intense sweetener includes U.S. Patent No. 4,983,405, A  
6 REDUCED AND LOW CALORIE SUGAR AND SUGARLESS CHEWING GUM  
7 COMPOSITIONS CONTAINING FIBER. It lists Talin as one of the group that can be used  
8 as the sweetener in chewing gum. U.S. Patent No. 5,342,631 also lists the use of thaumatin  
9 or Talin as one of the high intensity sweeteners that can be used in the petroleum wax-free  
10 chewing gum. U.S. Patent No. 5,059,428, Synergistic Sweetening Compositions Containing  
11 Polydextrose and a Chlorodexoxysugar and Methods for Preparing Same discloses possibly  
12 using talin as an intense sweetener in gum and in a sweetening composition with limited  
13 applications.

14 Another natural intense sweetener not approved yet by FDA in the U.S. at the present  
15 time is alitame. It is heat stable and 2000-3000 times sweeter than sucrose with no aftertaste.  
16 It is very stable under heat, pH, moisture and strong flavors.

17 The goal of making this invention as close to all natural as possible was important. The  
18 bulking ingredients in our preferred formula's 1 and 1A are all natural. This invention is to  
19 be used as a tool for those groups of people that have the need this invention solves. The  
20 invention needs to be as natural and safe as possible.

21 Third, even if the intense sweeteners could be baked, the aftertaste in the food product  
22 is not desirable. One complaint heard very often was that the intense sweeteners have a  
23 definite unpleasant aftertaste when used in food compositions. The need for a synergist



1 sweetener that has a real sugar taste is apparent. The public conception of intense sweeteners  
2 is clouded with their past experiences of intense sweeteners having a strong aftertaste with such  
3 limited applications.

4 Fourth, the need for a low calorie sugar is well known. See Table 1 for a comparison  
5 between intense sweeteners, bulk sweeteners, sweeteners.

TABLE 1

## SWEETENERS (SUGARS), INTENSE SWEETENERS, AND BULK

## SWEETENERS CHART

Type of Sweeteners	Name	Sweetness Intensity	Suitable for Diabetics	Natural	Caloric Value (kcal/g)	Water Solubility at room temp. (%)	Cooling effect	ADI (Accepted Daily Intake)	Caries Producing
Sugars	sucrose	1	no	yes	4	65			yes
	fructose	1.5	yes	yes	4	79			yes
Sugar alcohols	lactitol	0.4	yes	yes	2	60	slight	20 grams	no
	maltitol	0.8-0.9	yes	yes	3	60-90	slight	100 grams	no
Randomly polymerized dextrose	polydextrose	0	yes	yes	1	70	slight	100 grams	no
Fructooligosaccharides	inulin	less than 10	yes	yes	1	60-90	none	0	slight*
Intense Sweeteners	acesulfame-K	about 200	yes	no	0	20	none	15mg/kg body weight	no
	aspartame	about 200	yes	no	4	N/A	none	2.4 grams	no
	talin or thamestin	about 3000	yes	yes	4	N/A	none		no
	licorice extract	40	yes	yes	N/A	N/A	none	0	no

31 \*This bulk sweetener is tooth friendly. Any breakdown by bacteria in the mouth is so slow  
32 that there is no resultant tooth decay.

33  
34 The present invention is "low calorie" which means to have 1/2 the calories or less of  
35 sucrose. To make the present invention low or reduced calorie, bulk sweeteners have to have

1 less than the four calories per gram found in regular carbohydrates. The bulk sweeteners must  
2 be diabetic safe by not significantly raising the glucose and insulin levels in the blood. The  
3 search for bulk sweeteners falling within this category is very limited. Intense sweeteners are  
4 substances which are usually at least 40-3000 times as sweet as sucrose. The quantities of the  
5 intense sweeteners used are in such small quantities even if they did contain four calories per  
6 gram, the overall effect is minimal in calorie contribution and thus diabetic safe. Bulk  
7 sweeteners usually are less sweet than sucrose giving some added sweetness, bulk and texture  
8 to ingestible foods. The groups of bulk sweeteners available with fewer calories and diabetic  
9 safe usually fall into the category of polysaccharides. This group of bulk sweeteners is neither  
10 hydrolyzed nor absorbed in the small intestine. Thus, they reach almost unchanged into the  
11 lower bowel area. In the large intestine, the polysaccharides are fermented by the intestinal  
12 micro flora. They are metabolized into volatile fatty acids, CO<sub>2</sub>, and H<sub>2</sub>. Together with the  
13 increase in biomass this requires 50% or more of the available energy. The fatty acids are  
14 absorbed and metabolized further in the body resulting in an energy value of less than four  
15 calories per gram, usually falling within two calories per gram or less. This type of  
16 metabolism is in many ways similar to that of dietary fiber. These oligosaccharides and  
17 polysaccharides are metabolized independently of insulin and only contributes less than the  
18 calories of normal carbohydrates. In fact this makes them ideal for the diabetic person, who  
19 must not only watch the consumption of sugar but also the consumption the number of starches  
20 and sugars (carbohydrates) in their diet. Because of the way these carbohydrates are fermented,  
21 the diabetic individual does not have to count them as normal carbohydrates.

22 These bulk sweeteners are also known to be tooth friendly. "Tooth friendly" means  
23 that the oral bacteria cannot convert the polysaccharides into sugar and thus keep the pH in the

1 mouth from falling below 5.7 as does sucrose. These polysaccharides are poorly utilized by  
2 streptococcus mutans, an organism found in the human mouth which form's plaque and acids.  
3 One key to the streptococcus mutans failure to work is associated with a higher pH level that  
4 is in the human mouth during the time of eating these polysaccharides. Sugars normally lower  
5 the pH level while being metabolized in the human mouth thus providing the ideal pH setting  
6 to allow the streptococcus mutans to work in the best environment leading to caries. The prior  
7 art uses these polysacchrides as a bulking agent used in situations of reduced sweetening and  
8 reduced fat applications as partial replacements, especially in the art of creating low calorie,  
9 sugar free gums.

10 One of the major problems associated with the use of polysaccharides in a complete  
11 sugar substitute is the need to keep the levels or percentages by weight low in the synergistic  
12 sweetening composition if they have a lower acceptable daily intake (ADI). The major effects  
13 of increased levels of polysaccharides are softer stool, diarrhea and flatulence. Some  
14 polysaccharides acceptable for use in this type of application frequently have an ADI. Both  
15 the Joint Expert Committee for Foods (EEC, 1984) have evaluated and set the (ADI) 'not  
16 specified'. This ADI is set up as a guide to tell us how much can be eaten daily without  
17 causing the laxative effects except in sensitive individuals. As a result these polysaccharides  
18 have to be monitored to make sure that they are not eaten in large quantities especially in one  
19 sitting.

20 The bulk sweeteners or at least a portion of them must have similar physical properties  
21 of sugar. The bulk sweeteners including polysaccharides and oligosaccharides come in either  
22 crystalline, powdered or granulated forms. The present invention can use these bulk  
23 sweeteners in the powdered form, in the crystalline form, in the granulated form or mixtures

1 thereof. The other requirements are that they are soluble in water, heat stable, able to  
2 withstand changes in pH, have no aftertaste and hopefully have the same viscosity of that of  
3 sugar solutions. The boiling point and freezing point depression of these bulk sweeteners need  
4 to be the same or very similar to sucrose. The water activity of some bulk sweeteners influence  
5 product microbial stability and freshness; thus it is wise to pick one with similar molecular  
6 weight as close to sucrose. Picking the bulk ingredients that were natural and at least one of  
7 them to actually contribute soluble dietary fiber (so lacking in Western diets) was also  
8 important in the final criteria. In the prior art of the other patents using polysaccharides and  
9 oligosaccharides as bulk sweetener or bulking agents, no disclosures were made using all the  
10 criteria for choosing the correct bulking sweeteners. There have been no patents identified that  
11 included the need to monitor the bulking ingredients for ADI, the need to include bulk  
12 sweeteners with sucrose physical characteristics to achieve success in the problem area of  
13 baking and cooking, the need to invent a sugar replacement for brown sugar, and no mention  
14 of simple sugars to help the browning effect of baked products.

15       The bulk sweeteners used most often in the present invention are listed with references  
16 to prior art. Maltitol is a polyol alcohol with many characteristics of sugar (sucrose). It is  
17 derived from maltose. It has an ADI of 100 grams per day which is a very high ADI for a  
18 polyol alcohol. Maltitol also comes in a crystalline form which is .90 times as sweet as sucrose  
19 and makes it an ideal for use as a sugar substitute. It has three kcal/gram which is slightly  
20 higher in calories than some of the other sugar alcohols but when used together with the lower  
21 calorie bulk sweeteners it still helps reduce the overall kcal/g in the present invention. It is  
22 diabetic safe and tooth friendly. The calories are slightly higher than that of lactitol, but the  
23 ADI is five times higher making it better when you look at the laxative and flatulent side

1 effects. Lactitol was discovered in 1920 and has been available commercially since the early  
2 1980's. It is a disaccharide sugar alcohol produced commercially by the catalytic  
3 hydrogenation of lactose. Further purification by crystallization (monohydrate) and further  
4 processing ensures very high purity and flowability. It is 0.3 to 0.4 times as sweet as sucrose  
5 and has a caloric value of only two kcals per gram. Its ADI has been assigned at 20 grams per  
6 day, thus limiting the amount of lactitol that can be added in a sugar substitute.

7       The prior art listing lactitol and maltitol as a bulk sweetener in different applications  
8 is well known. Lactitol in the past has been used mainly in chewing gum applications because  
9 of the small amount needed. In the sugarless or low calorie gum patents listed above, they  
10 list polyol alcohol as a form of a bulk sweetener that can be used, and sometimes they are  
11 listed by name. U.S. Patent No. 5,043,169 discloses a stabilized dipeptide sweetening  
12 composition useful in chewing gum applications. This composition includes an encapsulated  
13 intense dipeptide sweetener wherein said inert material is selected from the group consisting  
14 of polyols, calcium phosphates, carbohydrates and mixtures thereof and wherein said polyol  
15 is selected from the group consisting of mannitol, xylitol, erythritol, sorbitol and mixtures  
16 thereof. U.S. Patent No. 5,098,730 by Tammy Pepper uses xylitol and a reduced calorie  
17 bulking agent in a reduced calorie, non-carcinogenic sweetener. Xylitol is a polyol alcohol  
18 but has a strong burning aftertaste especially used in larger quantities and it also is not a  
19 reduced calorie sweetener. It has the four kcal/ gram as does sucrose. Again U.S. Patent No.  
20 5,106,632 ENHANCED SWEETNESS OF ACESULFAME-K IN EDIBLE COMPOSITIONS  
21 discloses that the composition of the invention can be used in certain foods including a baked  
22 product such as a cake or cookie. The preferred products that employ the invention  
23 compositions are chewing gum and confectionery products. It also says that the composition

1 of the invention can be in association with suitable non-toxic carriers. These carriers can  
2 include lactitol, polysaccharides such as polydextrose, and others. It tries to include every and  
3 any combination, yet does not tell how to do this, and thus every type of food, recipe or  
4 possible use would have to be formulated separately to match the food use.

5 U.S. Patent No. 5,342,631 discloses the petroleum wax-free chewing gum containing  
6 special non-cariogenic oligosaccharides, sweeteners, and flavors. These non-cariogenic  
7 oligosaccharides are preferably low calorie and act as binders when formulated in the wax-free  
8 gums.

9 Claim 42 states:

10 The petroleum wax-free chewing gum of claim 22 wherein: a) the sweetener  
11 comprises a mixture of a high intensity sweetener at least 20 times sweeter than  
12 sucrose and at least one sugar alcohol selected from the group consisting of  
13 sorbitol, mannitol, xylitol, maltitol, lactitol, hydrogenated isomaltulose and  
14 hydrogenated starch hydrolysate: b) the binder system comprises at least one  
15 non-cariogenic oligosaccharide selected from the group consisting of  
16 indigestible dextrans, polydextroses, oligofructoses, isomaltulose  
17 oligosaccharides, and fructooligosaccharides, said oligosaccharides or their  
18 blends, being present in the binder system at between about 40 weight percent  
19 to about 90 percent of the total binder system.

20  
21 But again it is in a chewing gum in very small amounts, not in a sugar used to replace  
22 sugar in a one-to-one substitution in all types of ingestible foods.

23 The bulk sweetener polydextrose is well known in the art of replacement partially for  
24 sugar or fat in food products. It is a water soluble, low calorie, non-cariogenic bulk sweetener.  
25 Polydextrose can be bought in several forms that all contain quantities of unreacted monomers,  
26 such as glucose, sorbitol, as well as citric acid. Improved polydextrose is a randomly bonded  
27 condensation polymer of D-glucose with some bound sorbitol and citric acid. It is substantially  
28 free of certain low molecular weight organic acids (pH 3-4). Removal of these low molecular



1 weight organic acids has helped to eliminate the bad taste that has been known to be associated  
2 with polydextroses. Many patents issued have centered on the basis of masking the off taste  
3 so associated with polydextrose. It is found in a granulated powder that has an odorless,  
4 bland taste and a one kcal/gram low caloric value. The bland taste of improved polydextrose  
5 makes it necessary to use intense sweeteners, and the common art of using it with other bulk  
6 sweeteners in the area of sweeteners is well known. In the area of fat replacements it also  
7 needs flavorings, additional fat, and other bulk sweeteners conducive to fat replacing. It has  
8 an ADI of 90 grams per day which makes it more acceptable as a bulk sweetener to help  
9 lower the side effects of the lower amounts used of the lower ADI ingredients. The other  
10 benefit is that it is lower in cost than the inulin, lactitol or maltitol which is the reason for its  
11 inclusion as a portion of the total bulk of the present invention. The overall cost of this  
12 synergistic sugar replacement is important in the view of marketing it and the fact that  
13 customers need to be able to afford to use it. It has been recommended by a large  
14 manufacturer of improved polydextrose to not replace more than 40% of the sugar in a baked  
15 recipe (such as cookies, cakes, pastries, etc.) using this bulk sweetener. Some of the  
16 previously listed U.S. patents using polydextrose as a possible bulk sweetener are: U.S.  
17 Patent No. 5,342,631 used in chewing gum, U.S. Patent No. 5,106,632 in chewing gum, U.S.  
18 Patent No. 5,098,730 in a dietetic sweetening composition, U.S. Patent No. 5,043,169 in a  
19 stabilized sweetener composition useful in chewing gum applications, U.S. Patent No.  
20 4,983,405 possibly can use it in a sugar-free, low calorie chewing gum, and U.S. Patent No.  
21 5,059,428 uses this synergistic sweetening composition in chewing gum, some confectionery  
22 compositions, beverages, and the like. It does not work in all types of food applications as a  
23 complete sugar substitute. U.S. Patent No. 5,082,671 discloses using polydextrose as the sole



1 soluble bulking agent in a gum base. U.S. Patent No. 5,098,730 discloses using polydextrose  
2 as a preferred polymer type of bulking agent in sugar free boiled hard candies preferably with  
3 intense sweeteners added before or after the cooking of the candy. Again this is not a one-to-  
4 one sugar substitution in all ingestible foods. This patent uses it in one type of food, boiled  
5 hard candies. U.S. Patent No. 5,236,720 discloses a sugar-free, low calorie chewing gum  
6 utilizing polydextrose as the sole bulking agent. It also lists using a minor amount of one bulk  
7 sweetener selected from the group consisting of polydextrose, sugar, sugar alcohols and  
8 mixtures thereof. Again this is not a one-to-one sugar substitution in all ingestible foods.  
9 This patent uses it in one type of food, boiled hard candies.

10 Oligosaccharides are bulk sweetener which includes inulin derived by means of hot  
11 water extraction of chicory root a natural fructooligosaccharide (a 100% vegetable product).  
12 Inulin provides a synergist sweetening composition that is low calorie content with high dietary  
13 fiber using ingredients of natural origin and composition. Inulin has several bulk sweetening  
14 properties of sugar including excellent taste and synergistic properties. Inulin contributes  
15 several physiological properties and provides many surprising and unique beneficial health  
16 effects. These health benefits which are published by Imperial - Suiker Unie include: 1)  
17 reduced fecal pH; 2) modification of fecal micro flora (bifidogenic effect); 3) altered  
18 metabolism of bile acid; 4) reduction in toxic metabolites; 5) enhanced stool bulk and weight;  
19 6) accelerated stool transit; 7) reduction in constipation; 8) increased colon mucosal weight;  
20 9) reduced serum cholesterol and triglycerides; 10) reduced hepatic cholesterol and  
21 triglycerides; 11) reduced low density lipoprotein (LDL), increase in HDL/LDL ratio; 12)  
22 reduced blood pressure of elderly hyperlipemic people; 13) normalized blood glucose and  
23 serum lipids; 14) improves derangement of carbohydrate and lipid metabolism in diabetics; 15)

1 improved mineral absorption (Ca + 2, Mg+2, Fe+2, PO4-3); and 16) a potential source of  
2 energy in patients exhibiting malabsorption disorders. On the way to the digestive tract there  
3 is no breakdown of inulin by endogenous enzymes. This qualifies inulin as a solitary dietary  
4 fiber which possesses highly distinguishing properties such as an extremely low energy value.  
5 One kcal/gram of inulin has no ADI limits as do the other bulk sweeteners. Prior art using  
6 fructooligosaccharides are very limited and most of them use fructooligosaccharides in low fat  
7 applications. Inulin has a great tendency to absorb up to 1.5 times its weight. This can cause  
8 a negative effect if used as the only bulk sweetener in a 100% sugar replacement.

9 The U.S. Patent No. 5,342,631 lists a binder system possibly containing  
10 fructooligosaccharides in gum. U.S. Patent No. 5,169,671, FOOD CONTAINING  
11 FRUCTOSE POLYMER discloses using polyfructan, as a replacement in part or the  
12 whole for gelation materials, low calorie sugars and /or oils and fats. The patent uses the  
13 polyfructan as the necessary mass and volume bulking agent and also states that the food  
14 incorporating polyfructan may also contain a sweetener having a high degree of sweetness,  
15 i.e., aspartame. Low calorie baked products are named as a food that can be used. The  
16 patent doesn't state whether it is the fat replacement used in these foods or the sugar  
17 replacement. It is well known that aspartame does not bake well, nor does it do well under  
18 heat, pH., and moisture plus other facts listed above in the intense sweetener section. In  
19 the examples 10-17 given in the body of this patent, the baked food items used this  
20 invention to replace the shortening. Examples 24 & 25 used less sugar but the invention  
21 did not replace 100% of the sugar. Using only aspartame and a polyfructan, the sweetness  
22 would not be sufficient due to the loss of sweetness after baking to replace the sugar 100%.

1 Also each food had to be adjusted on a recipe basis as required when using the other  
2 compositions listed under the prior art above.

3 International Patent Publication # WO 93/02566, REDUCED CALORIE  
4 CHOCOLATE CONFECTIONERY COMPOSITIONS, by De Soete, J. discloses an  
5 invention of a reduced calorie chocolate confectionery composition which possibly may  
6 also have a reduced digestible fat content. The sugar is wholly and partially replaced by a  
7 product selected from the group consisting of inulin, branched inulin, linear  
8 fructoligosaccharides, branched fructoligosaccharides or a mixture thereof, with possibly a  
9 high intensity sweetener. It does list several bulking sweeteners that could possibly be  
10 added. This patent limits itself to chocolate confectionery compositions and not a sugar  
11 replacement for other foods.

12 The simple sugars found in inulin include naturally occurring mono and di-  
13 saccharide including fructose, sucrose and glucose. Inulin can be produced without the  
14 simple sugar fraction. This inulin has been shown to cause less flatulent gas than the inulin  
15 with the sugar fraction. Additional fructose can be added to help with the browning of  
16 baked ingestible foods. Fructose is a mono-saccharide that is 1 ½ times sweeter than  
17 sugar. It is commonly known as the sugar found in fruit. It is a carbohydrate that has four  
18 kcal/gram and is typically formulated in diabetic foods because it is absorbed only very  
19 slowly by passive transport or facilitated diffusion in the intestinal lumen, thus not  
20 contributing significantly to a blood sugar effect. These simple sugar components of the  
21 present invention are at concentrations that are relatively small as compared to the weight  
22 percentages of the inulin and the weight percentages of the bulk sweeteners in the present  
23 invention. The compositions simple sugar effects of the blood sugar are very minor, if not

1 negligible. In addition to their relatively small concentration, studies have shown through  
2 mediation effects of short chain fatty acids (SCFA's), produced from inulin fermentation in  
3 the stomach, inulin also reduces blood sugar effects of digestible carbohydrates, like  
4 sucrose and glucose, thus improving glucose tolerance. The amount of simple sugars is  
5 intentionally kept low. It is so low in fact that when the present invention is added to  
6 yeast dough, there is not enough sugar to feed the yeast for proper raising of the dough.  
7 In the case of yeast doughs, it is necessary to use some additional sugar to feed the yeast.  
8 Breads and rolls have been typically low in sugar anyway and have not been a problem for  
9 diabetics to eat in controlled portions. The prior art using fructose as a sweetener is well  
10 documented, but the only use of fructose in our invention is browning purposes of baked  
11 food products. U.S. Patents using simple sugars in this browning manner have not been  
12 located.

13

14

#### SUMMARY OF THE INVENTION

15 This invention pertains to a substitute for granulated sugars, brown sugars, and  
16 powdered sugars achieved by combining one or more intense sweeteners; two or more bulk  
17 sweeteners that include at least one oligosaccharide high in dietary fiber and bifidobacteria  
18 promoting; a small amounts of simple sugar sweeteners to help with the browning of the  
19 baked food products; anti-flatulent agents used to help to break up the gas created as the  
20 polysaccharides are metabolized by the intestinal micro flora; and flavoring agents. The sugar  
21 substitute is very stable under processing conditions including heat, pH, moisture, (including  
22 aldehydes), and ketones of cinnamon flavor and is a one-to-one substitution for granulated  
23 sugars, brown sugars, and powdered sugars.

1       The preparation and processing of this composition are very stable and not limited to  
2       heat, varying degrees of pH and moisture conditions. The composition will not significantly  
3       increase the glucose and insulin levels in the blood and is called "diabetic safe." This  
4       composition is formed whereby stable ingestible food is made having reduced calories, being  
5       diabetic safe, and having other health promoting benefits including the addition of soluble  
6       dietary fiber. These ingestible food products can include beverages, confectioneries including  
7       chocolates and candies, bakery items, main dishes, pharmaceutical products, salad dressings,  
8       frozen confectionery products, dairy products, oral hygiene products and jams and jellies. The  
9       food preparations are comparable in taste, appearance, texture and to real sugar food  
10      products.

11       The present invention is a non-toxic, low calorie, diabetic safe, tooth friendly  
12      synergistic sweetening composition that can be used to substitute the whole of the  
13      granulated, brown sugar and powdered sugar in ingestible food products. The very stable  
14      synergistic sweetening compound also can be used in many types of preparations and  
15      processing techniques. The one-to-one substituting of sugar makes it easy for all types of  
16      cooks to substitute the whole of the sugar in recipes and applications without tedious recipe  
17      adjustments. Prior art shows that each type of food and food composition had to be  
18      adjusted individually to replace at least part or the whole amount of the sugars with at least  
19      one intense sweetener and possibly adding bulk sweeteners.

20       The present invention is a timely answer to diabetics, obese individuals or  
21      individuals who are sugar intolerant and suffering from other major life threatening  
22      diseases. The present invention met several criteria important to solving many of the

1 problems associated with the use of intense sweetener and bulking sweeteners. The  
2 synergistic sweetening composition has the following properties:

- 3 1) retains its sweetness under heat, varying degrees of pH, and moisture;
  - 4 2) synergizes with the available intense sweeteners and bulking sweeteners to  
5 release a pleasant, well rounded, natural sugar taste;
  - 6 3) solves the bulk problem well known in the art of baking and cooking;
  - 7 4) is diabetic safe;
  - 8 5) is tooth friendly;
  - 9 6) has lower calories than sucrose by at least 50 %;
  - 10 7) is high in soluble dietary fiber;
  - 11 8) selects ingredients that have health benefits, such as the benefits attributed to  
12 inulin; and
  - 13 9) picks as many all natural ingredients as possible that work together;
- 14 One-to-one replacement means duplicating the weight, volume measurements and  
15 characteristics of real sugar as close as possible. This makes the measuring and use of the  
16 present invention as easy as it is using and measuring real sugar. To make the measurement  
17 system work, bulk ingredients need to be used with as close as possible granular,  
18 crystalline, or powdered sugar to the match size of sucrose that you are trying to replace.  
19 An example of this is that you pick the lactitol and maltitol the same crystalline size as  
20 granulated sucrose when making formula 1 and 1A, or slightly larger so that it will make  
21 up for the inulin which does not come in a form that is crystalline or is as heavy per  
22 granular as sugar. This way the preferred invention formula will weigh as much as sugar  
23 cup for cup. It is important to take all this into consideration when engineering the formula

to measure one for one for granulated sugar, brown sugar and powdered sugar. See Table 2 - Volume and Weight Measurement Comparisons.

TABLE 2  
VOLUME AND WEIGHT MEASUREMENT COMPARISONS

WEIGHT	200g	200g	120g	120g	200g
SUGAR OR SUGAR/SUB.	GRANULATED SUGAR	FORMULA 1/1A GRANULATED	POWDERED SUGAR	FORMULA 2/2A POWDERED	BROWN SUGAR
VOLUME-MEASUREMENT	1 CUP	1 CUP	1 CUP	1 CUP	1 CUP

Polysaccharides release gas when fermented in the colon. The bulk sweeteners had to be added to the present invention with ADI and possible side effects in mind. The goal was to reduce the unpleasant side effects of flatulent gas as much as possible by the percentages by weight of these ingredients as the synergistic sweetening composition was formulated. Research into relief of the flatulent gas was paramount in including an anti-flatulent agent that could work after undergoing various preparation and processing techniques. Research into how the human body handles fibers and polysaccharides is very similar. When fiber is ingested in a large amount for the first time, the side effects are similar to eating polysaccharides for the first time. As we introduce both the fiber and polysaccharides into our diet, slowly our bodies build up a tolerance to the side effects. More and more of the fiber, polysaccharides, or both can be ingested. Increase in water consumption can also help with the amount of flatulent gas formed. A small amount of a mono or di-saccharide can be added to help the browning of the baked food product. Sugars can cause the desired browning in an ingestible food by the method of caramelization. Caramelization occurs when sugars are heated to such intense temperatures



1 that they melt and a series of chemical reactions begin to take place, which ultimately can  
2 lead to a charred or burned product if not careful. Some caramelization is desired. The  
3 Maillard Reaction is another way ingestible foods brown is described as non-enzymatic  
4 browning. It to is a series of reactions involving the condensation of a sugar and an amine.  
5 During the course of this series, the product is transformed from an essentially colorless  
6 substance to a golden color and darker if not watched. Natural fructose is the preferred  
7 embodiment because it is easily tolerated by diabetics. Inulin can contain up to 8% of free  
8 mono-and di-saccharide.

9       The study of Table 3 shows the blood glucose levels in the blood after a four hour  
10 fast. The person tested was then given 12.5 grams (1 tablespoon) of glucose in water and  
11 their blood glucose levels were tested every 15 minutes up to an hour. Again the same  
12 persons blood glucose levels were tested after 4 hours of fasting and then ingesting 12.5  
13 grams (1 tablespoon) of Formula 1 of the present invention in water. The testing continued  
14 every 15 minutes for 1 hour. The study shows how the body can handle the present  
15 invention without significant increases in the blood glucose and insulin levels.

TABLE 3

## BLOOD GLUCOSE COMPARISON TEST RESULT

Person Tested	#1	#2	#3	#4	#5	#6
Fasting Blood Sugar mg/dl	82	83	87	80	77	89
Blood Sugar after eating 12.5 grams of glucose mg/dl						
15 min.	90	93	97	86	88	102
30 min.	121	125	130	119	135	125
45 min.	113	110	116	118	121	118
1 hour	110	108	112	111	115	99
Fasting Blood Sugar mg/dl	77	80	82	83	79	85
Blood Sugar after eating 12.5 grams of Formula #1 mg/dl						
15 min.	78	81	84	83	78	86
30 min.	78	82	85	82	77	84
45 min.	76	79	81	80	77	83
60 min.	74	78	79	79	75	82

The argument can be made that when using the present invention as a one-to-one substitution for the whole of the sugar in ingestible foods that you replace it with a composition that has a small amount of simple sugars in it. This is true, but the goal of using this invention as a one-to-one substitution is to make it easy to substitute the total amount of sugar called for with the same amount of the present invention. The simple sugars have been added only as a browning agent to help the overall performance of the present invention in the area of baking. The present invention does work in all types of

1 applications without the small amount of simple sugars. The sugars can be optionally  
2 added to help with the browning effect. Great care has gone into making this synergistic  
3 sweetening composition an overall sugar substitution for all types of applications while at  
4 the same time keeping the present invention diabetic safe.

5 Other objects, advantages, and capabilities of the present invention will become  
6 more apparent as the description proceeds.

7 The method for manufacturing synergistic sweetening composition comprises:

- 8 (a) preparing a diluted mixture of intense sweeteners and water at a correct  
9 strength needed for the composition;
- 10 (b) spraying the diluted mixture over bulk sweeteners;
- 11 (c) drying the above mixture;
- 12 (d) mixing the bulk sweeteners and intense sweeteners in a drum mixer for about  
13 20 minutes until completely dispersed;
- 14 (e) adding the intense sweeteners, the flavor enhancer and the anti-flatulent  
15 agent to the bulk sweeteners and intense sweeteners and mixing until  
16 completely dispersed;
- 17 (f) pouring the finished mixture into air tight packaging and sealing.

18

#### 19 DETAILED DESCRIPTION OF THE INVENTION

20 In accordance with the present invention, it has been found that the synergistic  
21 properties of the intense sweeteners and bulk sweeteners have increased dramatically the  
22 overall effect in foods. Synergy is the level of perceived sweetness that becomes the  
23 greater than the sum of the parts. It increases the pleasant sugar taste in all types of

1 ingestible foods. The sweetness in this invention is retained under processing conditions  
2 including, but not limited to the pH, moisture, and heat. This makes it ideal for processed  
3 ingestible foods that undergo high intense heat. The only exception known is that there is  
4 not enough mono or di-saccharide in the invention to feed the yeast necessary to raise yeast  
5 doughs. The synergistic effect makes it possible to use less of each of the intense  
6 sweeteners (up to almost 50% less) of two intense sweeteners combined compared to 100%  
7 of the original intense sweetener's sweetness level. This lowers the cost of the amount of  
8 intense sweeteners used but also increases the synergy of the bulk sweeteners. The synergy  
9 effect is also found to be flavor-enhancing characteristics that have been demonstrated by  
10 masking many "aggressive" flavors such as cinnamon, peppermint, ginger, coffee, etc.  
11 The addition of a natural flavor enhancer, ethyl maltol also clarifies the cotton candy flavor  
12 used in table top testing.

13       The present invention solves the bulk problem so necessary when replacing all the  
14 sugar in a baked food product. In the past, taking two cups of sugar out of a cake recipe  
15 and replacing it with a small amount of intense sweetener or even a partial bulking agent  
16 caused the texture, appearance, and taste to be lacking. Baking and cooking recipes  
17 contain many ingestible food products that simply do not turn out the same if the bulk is  
18 not replaced. The bulk sweeteners should have many of sucrose's physical characteristics  
19 including and not limited to solubility, sweetness, viscosity, and tolerance to heat.

20       The present invention can be used in a one-to-one substitution of granulated sugar  
21 and with the simple addition of a brown sugar or molasses flavoring at the time of mixing,  
22 it can replace brown sugar in all ingestible foods. Many recipes call for brown sugar and  
23 would be very limiting if you used the present invention to substitute the granulated sugar

1 and still left in the brown sugar. The synergistic sweetening composition is prepared with  
2 the addition of brown sugar flavoring, molasses flavoring, or mixtures thereof in ingestible  
3 foods. See Table 4 - Brown Sugar Substitution Chart.

TABLE 4

## BROWN SUGAR SUBSTITUTION CHART

7 Brown Sugar = Brown Sugar Flavoring & Invention

8 1/2 cup	1/2 tsp	1/2 cup
9 1 cup	1 cup	1 cup
10 1 pound	2 tsp	1 pound

12 The present invention can also be used in a one-to-one substitution of powdered sugar.  
13 The bulk sweeteners must be in powdered form to add a pleasant mouth feel. The invention  
14 used in a one-to-one substitution of the whole powdered sugar in ingestible food includes but  
15 is not limited to icings, frostings, sprinkled on food, candy, and marshmallows.

16 The significant aspect of the one-to-one substitution is the ease in substituting all the  
17 sugar in ingestible foods without complicated experimentation on each food product. The  
18 consumer, whether a home cook, chef, a restaurant cook, manufacturer of large volumes of  
19 ingestible products, or anyone else that will use this invention will not have to adjust the sugar  
20 substitution amounts for each recipe because that time consuming detail has been eliminated.  
21 The mixing and addition of this invention to ingestible food are exactly like adding sucrose or  
22 other sugars into the same foods with no special instructions.

23 The present invention is diabetic safe. That means that the carbohydrates (excluding  
24 the simple sugars) do not have to be counted by a diabetic person, whereas in sugar and starch

1 carbohydrates this is not the case. The bulking ingredients used in the present invention are  
2 labeled nutritionally under "other" carbohydrates except for the small amount of the simple  
3 sugars. The diabetic individual does not have to count these as carbohydrates that can  
4 significantly raise or lower the glucose of insulin in their blood. The labeling of foods made  
5 with the invention can be labeled "reduced or low calorie" depending on the finished ingestible  
6 food's final nutritional information, "diabetic safe" or "tooth friendly". The finished ingestible  
7 food product can even be more reduced calorie or low calorie when used in conjunction with a  
8 fat substitute. This is so important to the individual who is obese or diabetic.

9       If the present invention uses the pearl aspartame as one of the intense sweeteners, it  
10 has been reported by Holland Sweetener Company that this particular type of aspartame bakes  
11 better if used in a low fat mixture. Such an example of this is using it in conjunction with the  
12 one-to-one low fat substitute disclosed in patent application no. 08/516,868 filed on 08/81/95  
13 by the same inventor. In using the pearl aspartame as part of the invention with the one-to-one  
14 fat substitution no undesirable effects are observed. If the food mixture is high in fat,  
15 sometimes the pearl form of aspartame leaves behind small hard balls of undissolved aspartame  
16 especially in foods such as cookies that are cooked a shorter period of time. Still, the pearl  
17 form of aspartame is preferred over the encapsulated form of aspartame as previously  
18 described. It bakes and retains its sweetness better in baking and cooking application than the  
19 encapsulated form.

20       The method to produce the synergistic sweetening composition includes the following  
21 steps. First, if using an intense sweetener such as talin or any sweetener that is at least 2000  
22 times sweeter than sucrose, it has to be diluted to the strength needed in the embodiment.  
23 Talin is 3000 times sweeter than sucrose and over \$12,000.00 dollars a kilogram. With the

1 synergistic effect of using it with a combination of other intense and bulk sweeteners the talin  
2 sweetness can increase up to 40,000 times sweeter than sucrose. Using such small amounts of  
3 talin require that the talin be diluted in a water to the strength needed in this present invention  
4 and then sprayed evenly over one of the bulk sweeteners or sweeteners, such as the fructose.  
5 That way the talin would be evenly dispersed throughout the embodiment and not be lost by  
6 using minuscule amounts.

7 Second, the rest of the bulk sweeteners and sweetener (fructose) that include the talin  
8 are mixed in a rotating drum mixer until completely dispersed. The acesulfame-K, or other  
9 intense sweeteners, that are around 300 times sweeter or less can be added with the anti-  
10 flatulent agents, Yucca schidigera extract or other anti-flatulent agents, to natural flavor  
11 enhancer ethyl maltol. They need to be added toward the end of the process and mixed until  
12 evenly dispersed. The humidity the day of the mixing should be low to prevent caking and  
13 ingredients sticking together. Lastly, the composition is poured and sealed into air tight  
14 packaging and stored in a cool dry place.

15 The method of processing reduced calorie and diabetic safe ingestible products using  
16 the present invention includes normal preparation methods, i.e. baking, cooking, mixing of  
17 uncooked mixtures, table top use, and manufacturer's processing techniques, etc., as described  
18 later in Examples 1-12 - Ingestible Foods-Sugar and Fat Comparisons.

19 The present invention contains one or more intense sweeteners that can be derived  
20 from the following groups of tooth friendly, natural and synthetically made intense sweeteners.

21 The groups consisting of dipeptides such as aspartame includes both the encapsulated  
22 and pearl forms, acesulfame-K and its salts, thaumatin or talin with or without Arabic gum,  
23 saccharin and its salts, cyclamate and its salts, chlorodeoxysugar derivatives such as sucralose,



1    alitame, xylitol, stevioside, glycyrrhizin, dihydrochalcones, monellin,  
2    chlorodeoxygalactosucrose derivatives, the icorice extract, or mixtures thereof. Each of these  
3    intense sweeteners has a distinct sweetening intensity compared to sucrose.

4            These intense sweetening agents of the present invention can be used in many physical  
5    forms well known to the art. These physical forms can include spray dried, powdered, beaded,  
6    pearl, encapsulated forms, liquid form in use in liquid sweeteners and mixtures thereof.

7            The present embodiments further comprise the use of one or more bulk sweeteners or  
8    agents that can be derived from the following groups of natural and synthetically made non-  
9    cariogenic bulk sweeteners. These bulk ingredients fall into the category of diabetic safe and  
10   tooth friendly. They need to have less calories per gram than 4 k/cal per gram found in  
11   carbohydrates from sugars and starches. The first group consists of polyol alcohols that  
12   include lactitol, maltitol, mannitol, sorbitol, erythritol, galactitol, isomaltulose, polyglucose,  
13   polymaltose, carboxymethylcellulose, carboxyethylcellulose, arabinogalactan, microcrystalline  
14   cellulose, polydextrose and improved polydextrose, palatinit, indigestible dextrins, or mixtures  
15   thereof.

16           The present embodiments further comprise the use of one or more oligosaccharides  
17   from the second group consisting of inulin, branched inulin, linear fructo-oligosaccharides  
18   formed from hydrolysis of inulin, branched fructo-oligosaccharides formed from fructosyl  
19   transferase reaction on sucrose, or mixtures thereof. The inulin can be derived from chicory  
20   extract or from over 35,000 other plants containing inulin. The fructooligosaccharides are  
21   obtained from processes used on saccharose, fructose, fructans, levans, from their products of  
22   hydrolysis, or from the plants with fructans.

1       The synergistic sweetening composition is comprised of one or more mono or di-  
2    saccharides to be added or occur naturally in the oligosaccharide. The addition of this group  
3    is to help in the browning of the finished baked product only. These sweeteners are  
4    considered simple sugars and have four kcal. per gram. They are listed under carbohydrate -  
5    sugar on a nutritional label. The small amount of the simple sugars is important so that it will  
6    not significantly raise the glucose and insulin levels of the blood when used in the present  
7    invention in ingestible foods. The group consists of fructose, glucose, sucrose, or other  
8    simple sugars, or mixtures thereof.

9       The synergistic sweetening composition contains one or more anti-flatulence agents  
10   which include lactobacillus acidophilus cultures, yucca schidigera extract, or simethicone, to  
11   help with the discomfort of the gas produced in the large intestine or colon caused by the  
12   fermentation of the polysaccharides by the micro flora. This addition of these agents does not  
13   affect in any way how the present invention sweetens or works as a sugar replacement. The  
14   research on anti-flatulence ingredients that can withstand high temperatures of processing after  
15   being added to the present invention is not known. In fact the whole area of anti-flatulent  
16   agents that work in the large intestine or colon after the ingestion of ingestible foods is very  
17   limited. There is quite a bit of research on simethicone as an anti-flatulent which is believed to  
18   work as an anti-foaming drug which helps to break up the gas bubbles in the colon. It is used  
19   in many over-the-counter drugs for indigestion, diarrhea, flatulence, heartburn, etc. To work  
20   in the present invention, it can be encapsulated with various coatings to work more effectively  
21   after the baking, cooking or processing in high temperatures. Lactobacillus acidophilus  
22   culture has many of the same characteristic benefits of the inulin as far as the bifidogenic  
23   effects in the colon are concerned. It also has been known to help with flatulent gas. The

1 drawback of using this as an ingredient in the present invention is that the bacteria and  
2 enzymes in this culture are not heat resistant and are killed off when heated in ingestible food  
3 products that require baking and cooking especially with longer cooking times. Still some  
4 small helpful effects are left from the products left after the metabolism of the other  
5 components of the culture by the lactobacillus bacteria. The actual by-product that  
6 accomplishes this effect is unknown at this time. Yucca schidigera extract is known as a  
7 natural anti-foaming agent and is not a drug. It has never been used before as an anti-flatulent  
8 agent. The research on the testing of yucca schidigera as an anti-flatulent agent is non-  
9 existing. It seems to work in the same way as simethicone does as an anti-foaming agent in  
10 the large colon to help break up the large gas bubbles. In some forms it can have a very  
11 strong taste and can be encapsulated to mask the strong flavor when incorporated into the  
12 present invention.

13       The present invention composition looks like a white, dry, slightly powdered and  
14 crystalline composition. It has a sweet cotton candy flavor when tasted by itself. The  
15 invention is water soluble and the flavor becomes more sugar-like when it is mixed into liquid  
16 used in food processing. The solubility of the invention increases as the temperature rises and  
17 it thus increases in sweetness. See Table 1- Sweeteners (Sugars), Intense Sweeteners, and  
18 Bulk Sweeteners Chart. It is readily soluble in water and can rapidly dissolve and be easily  
19 mixed into foods and beverages without new mixing instructions. The sweetness of the  
20 composition is usually very rapidly perceived providing an "impact" sweetness and the  
21 synergistic effects of the ingredients gives it a well-rounded profile. The present invention is  
22 very stable if stored air tight and in a cool, dry place. Some of the ingredients have a tendency  
23 to be hygroscopic and can absorb water from the humidity in the air if not covered well. It is

1 still stable when exposed to high temperatures for a limited time period which can occur under  
2 unfavorable storage conditions.

3 The form of the present invention can be put into bulk packaging for consumers or  
4 commercial use, measured packets, tablet form, dissolved in a liquid for a tabletop sweetener if  
5 so desired or in the case of a liquid sweetener used in certain food production or other types  
6 of uses. Liquid glucose and fructose syrups are examples of a liquid sweetener used in many  
7 special applications.

8 The present invention consists of one or more natural or artificial intense sweeteners.  
9 One goal is to achieve an all natural synergistic sweetening composition, but taste overrules  
10 the natural sweetener requirement. The intense sweeteners are at a level of from about 0.001  
11 to 8 weight percent. Two intense sweeteners are used in the preferred embodiment. The  
12 present invention consists of two or more natural or artificial bulk sweeteners at a level of  
13 from about 0.5 to 99 weight percent. The preferred embodiment includes two natural bulk  
14 sweeteners. The present invention consists of one or more of the bulk sweeteners to include a  
15 natural or artificial oligosaccharides. The oligosaccharide in the preferred invention is natural  
16 inulin from chicory root. The present invention consists of one or more natural or artificial  
17 sweeteners which include mono or di-saccharide to help with browning at a level of from  
18 about 1 to 15 weight percent. The preferred embodiment can include naturally occurring  
19 fructose, glucose, and sucrose in inulin and additional fructose. The synergistic sweetening  
20 composition consists of one or more, natural or artificial anti-flatulent agents at a level of from  
21 about .001 to 5 weight percent. The present invention consists of one or more flavoring agents  
22 at a level of from about .0001 to 5 weight percent. The preferred embodiment includes a

1 natural flavor enhancer, ethyl maltol and a natural brown sugar flavoring to use in brown  
2 sugar replacement.

#### 4 FORMULAS

5 The present invention embodiment has two preferred formulas for granulated or brown  
6 sugar listed as Formula 1 and Formula 1A. And two preferred formulas for powdered sugar  
7 Formula 2 and Formula 2A. Note that the mixing instructions have been described previously.

#### 9 FORMULA 1 Granulated or Brown\* Sugar

10 TYPE	INGREDIENT	WEIGHT PERCENT
11 Intense	Acesulfame-K Talin	.0015% .0001%
12 Bulk	Inulin from chicory extract Maltitol Lactitol	50% 33.98% 12%
13 Sweetener	Fructose	4%
14 Anti-Flatulent Agent	Yucca schidigera extract	.0084%
15 Flavoring Agents	Ethyl maltol	.01% 100%

16  
17 \* Add brown sugar or molasses flavoring according to Table 4 when substituting for brown  
18 sugar.

## NUTRITIONAL INFORMATION FOR FORMULA 1

	FORMULA 1	GRANULATED SUCROSE	LESS CALORIES
WEIGHT	100g.	100g.	52.7% less
VOLUME-MEASURE	½ cup	½ cup	
CALORIES			
TOTAL	189k cal	400k cal	
CARBOHYDRATES			
SUGARS	97g.	100g.	
STARCHES	8.3g.*	100g.	
	0	0	
OTHER**			
DIETARY	45.5g	0	
FIBER	43.2g.***	0	
% OF CALORIES			
FROM	17.5%	100%	
CARBOHYDRATES-SUGAR			

\* Some samples of insulin contain less than 8.6% simple sugars.

\*\* "Other" carbohydrates are not counted as carbohydrates to the diabetic. These 'other' carbohydrates do not significantly raise the glucose or insulin levels of the blood and they have less than 4 k cals per gram found in sugars and starches.

\*\*\*Solitary Dietary Fiber from inulin.

## FORMULA 1A Granulated and Brown\* Sugar

INGREDIENTS	WEIGHT PERCENT
Acesulfame-K	.0015%
Aspartame™	.0015%
Lactitol	12%
Maltitol	23.9056%
Inulin	50%
Improved polydextrose	10%
Fructose	4%
Simethicone	.0814%
Ethyl maltol	.01
TOTAL	100%

\* Add Brown Sugar Flavoring to the invention according to Table # 4 when substituting for brown sugar.

## NUTRITIONAL INFORMATION FOR FORMULA 1A

	FORMULA 1A	GRANULATED SUCROSE	LESS CALORIES
WEIGHT	100g.	100g.	
VOLUME-	½ cup	½ cup	
MEASURE			
CALORIES	169.7k cal	400k cal	57.5% less
TOTAL			
CARBOHYDRATES	96.5g.	100g.	
SUGAR	8.3g.*	100g.	
STARCH	0	0	
OTHER	45g.**	0	
DIETARY	43.2g.***	0	
FIBER			
% OF CALORIES	19.6%	100%	
FROM			
CARBOHYDRATES			

\* Some samples of inulin contain less than the 8.6% simple sugars used.

\*\* The carbohydrates listed under "other" do not need to be counted by diabetics as carbohydrates.

The "other" carbohydrates do not significantly raise the glucose and insulin levels in the blood when they are fermented. They have less than 4k cals per gram found in sugars and starches.

\*\*\* Solitary Dietary Fiber from inulin.



**THE SYNERGISTIC COMPOSITION FOR ONE-TO-ONE REPLACEMENT OF  
POWDERED SUGAR**

**FORMULA 2 Powdered Sugar**

**INGREDIENTS**

**WEIGHT PERCENT**

(same ingredients as

(same weight percent as Formula 1)

formula 1 except in the

powdered form)

The exception being that all granulated bulk sweeteners and sweeteners have to be in the powdered form for the proper mouth feel and texture.

**NUTRITIONAL INFORMATION FOR FORMULA 2**

	FORMULA 2	POWDERED SUGAR	LESS CALORIES
WEIGHT	120g.	120g.	
VOLUME-MEASURE	1 cup	1 cup	
CALORIES			
TOTAL	226.8k cal	466k cal	51.3% less
CARBOHYDRATES			
SUGAR	116.4g.	116.5g.	
STARCH	9.96g.*	116.5g.	
	0	0	
OTHER			
DIETARY	54.6g.	0	
FIBER	51.84g.***	0	
% OF CALORIES			
FROM	17.6%	100%	
CARBOHYDRATES			

\* Some samples of inulin contain less than the 8.6% simple sugars used.

\*\* The carbohydrates listed under "other" do not need to be counted by diabetics as carbohydrates.

The "other" carbohydrates do not significantly raise the glucose and insulin levels in the blood when they are fermented. They have less than 4k cal per grams found in sugars and starches.

\*\*\* Solitary Dietary Fiber from inulin.

### FORMULA 2 Powdered Sugar

#### INGREDIENTS

#### WEIGHT PERCENT

(same ingredients as formula 1A except in the powdered form)

(same weight percent as Formula 1A)

### NUTRITIONAL INFORMATION FOR FORMULA 2A

	FORMULA 2A	POWDERED SUGAR	LESS CALORIES
WEIGHT	120g.	120g.	
VOLUME-MEASURE	1 cup	1 cup	
CALORIES			
TOTAL	203.6k cal	466k cal	56.3% less
CARBOHYDRATES			
SUGAR	115.8g.	116.5g.	
STARCH	9.96g.*	116.5g.	
	0	0	
OTHER			
DIETARY	54g.**	0	
FIBER	51.84g.***	0	
% OF CALORIES			
FROM	19.6%	100%	
CARBOHYDRATES			

\* Some batches of inulin have less than 8.6% simple sugars.

The 'other' carbohydrates are diabetic safe and do not need to be counted as the carbohydrates called sugar and starches. They do not significantly affect the glucose and

1 insulin levels of the blood. The "other" carbohydrate, when fermented in the large colon, have  
2 less than 4k cal per grams found in sugars and starches.

3 \*\*\* Solitary Dietary Fiber is from the inulin.

#### 4 Examples 1-12

5 Each example is in three parts, i.e. A, B and C. "A" is an ingestible food made with  
6 regular sugar and fat. "B" is an ingestible food that the sugar has been replaced with one of  
7 the formula's of the present invention and labeled as a sugar substitute. "C" is an ingestible  
8 food where not only has the sugar been replaced with one of the formulas of the present  
9 invention, but also the fat was replaced with a 93% less fat than butter, one-to-one fat  
10 substitute. The low-fat substitute used in the examples has nutritional characteristics as  
11 follows in 100 grams of the product.

Product	Value
Calories	285
Total/Carbohydrates	57.5g
Sugar	0g
Starch	57.5g
Total Fat	5.94g
Saturated	3.92
Monosaturated	1.43
Polyunsaturated	.18g
Cholesterol	15mg
Sodium	356mg

12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24 The purpose of the examples is to show the reduction in sugar and calories using the  
25 present invention on its own compared to a high sugar example A., but when used in  
26 conjunction with a low fat substitute as in patent application 08/516,868 the reduction in

1 calories are very significant, i.e. close to 50% less, and the sugar reduction stays the same.  
2 The present invention can be used with a low fat substitute to show impressive calorie  
3 reduction plus significant sugar reduction.

4 To understand the following examples, please note the following:

- 5 1) The total carbohydrates equal all available carbohydrates. The figure in the  
6 parenthesis is the total carbohydrates a diabetic needs to count. The "other" carbohydrate is  
7 subtracted from the first figure in example 1 B. Butter Toffee/Formula 1 sugar substitute:  
8 Total Carb g. 2.6(.22) where 2.6g is the carbohydrate including the "other" and the (.22)g is  
9 the carbohydrate that a diabetic must count.
- 10 2) The Sugar figure is only the granulated, powdered, brown sugar or present  
11 invention known as Formula 1 and 1A and Formula 2 and 2A in the recipe. By figuring just  
12 these sugars and the present invention the comparisons are more direct. The simple sugars  
13 found in the other ingredients are not figured into the sugar grams only into the total  
14 carbohydrates.

# **EXAMPLES INGESTIBLE FOOD SUGAR AND FAT COMPARISONS**

Example #1	A.	C.	Nutritional Information
Butter Toffee/regular		Butter Toffee/Formula 1 sugar substitute/low fat	serving size 1/8 calories 368 fat g 12.9 total/carb g 65 sugar g starch g other g dietary fiber g 0.3
1 cup butter		1 cup low fat butter replacement	
1 cup granulated sugar		1 cup Formula 1 sugar substitute	
3 tbsp pecans, chopped		3 tbsp pecans, chopped	
Nutritional Information		Nutritional Information	
serving size 1/75		serving size 1/75	66% of total calories from sugar 29% of total calories from fat
calories 33.7		calories 15.3	
fat g 2.6		fat g .04	
total/carb g 2.7		total/carb g 4(1.64)	
sugar g 2.66		sugar g .22	
starch g		starch g	
other g 0		other g 1.21	
dietary		dietary	
fiber g 0		fiber g 1.15	
32% of total calories from sugar		5.75% of total calories from sugar	
82% of total calories from fat		2% of total calories from fat	
B.		54.5% less calories	
Butter Toffee/Formula 1 sugar substitute		Example #2 A.	Lemon Meringue Pie/Formula 1 sugar substitute
1 cup butter			1 whole pie crust 1 1/2 cup Formula 1 sugar substitute 3 1/2 tbsp cornstarch 1 1/2 cup water 4 each egg yolks 1/2 cup lemon juice 3 tbsp butter 2 tbsp lemon peel
1 cup Formula 1 sugar substitute			1/2 cup egg whites 1/4 tsp cream of tartar 1/2 cup Formula 1/ sugar substitute 1/2 tsp vanilla
3 tbsp pecans, chopped			
Nutritional Information			
serving size 1/75		1 whole pie crust	
calories 28.5		1 1/2 cup granulated sugar	
fat g 2.6		3 1/2 tbsp cornstarch	
total/carb g 2.6(.22)		1 1/2 cup water	
sugar g .22		4 each egg yolks	
starch g		1/2 cup lemon juice	
other g 1.21		3 tbsp butter	
dietary		2 tbsp lemon peel	
fiber g 1.15			
3% of total calories from sugar		1/2 cup egg whites	
82% of total calories from fat		1/4 tsp cream of tartar	
15.4% less calories		1/2 cup granulated sugar	
		1/2 tsp vanilla	
			Nutritional Information
			serving size 1/8 calories 278 fat g 12.9 total/carb g 64(19.7) sugar g 4.15 starch g other g 22.75 dietary fiber g. 21.6
			6% of total calories from sugar

1	29% of total calories	dash salt	11.5% less calories
2	from fat	6 cups apples sliced	
3	24% less calories	2 tbsp butter	C.
4			
5	C.		Apple Pie/Formula 1A
6			sugar substitute/low fat
7	Lemon Meringue Pie/ Formula 1		substitute
8	sugar subst/low fat		
9		Nutritional Information	2 whole low fat pie crusts
10	1 whole low fat pie crust		3/4 cup Formula 1A/ sugar
11	1 1/2 cup Formula 1 sugar	serving size 1/8	substitute
12	substitute	calories 363	1/4 cup flour
13	3 1/2 tbsp cornstarch	fat g 15.4	1/2 tsp nutmeg
14	1 1/2 cup water	total/carb g (54.8)	1 tsp cinnamon
15	4 each egg yolks	sugar g 18.75	dash salt
16	1/2 cup lemon juice	starch g	6 cups apples sliced
17	3 tbsp low fat substitute	other g	2 tbsp fat substitute
18	2 tbsp lemon peel	dietary	
19		fiber g	
20	1/2 cup egg whites		Nutritional Information
21	1/4 tsp cream of tartar	20% of total calories from sugar	
22	1/2 cup Formula 1/	38% of total calories	serving size 1/8
23	sugar substitute	from fat	calories 175
24	1/2 tsp vanilla		fat g 1.3
25		B.	total/carb g 49.7(33.17)
26			sugar g 1.53
27	Nutritional Information	Apple Pie/Formula 1A	starch g
28		sugar substitute	other g 8.43
29	serving size 1/8	2 whole pie crusts	dietary
30	calories 216	3/4 cup Formula 1A/ sugar	fiber g 8.1
31	fat g 1.2	substitute	
32	total/carb g 73(28.65)	1/4 cup flour	3% of total calories from sugar
33	sugar g 4.15	1/2 tsp nutmeg	7% of total calories
34	starch g	1 tsp cinnamon	from fat
35	other g 22.75	dash salt	52% less calories
36	dietary	6 cups apples sliced	
37	fiber g 21.6	2 tbsp butter	Example #4
38			A.
39	8% of total calories from		
40	sugar		
41	5% of total calories	Nutritional Information	Sweet & Sour Chicken/regular
42	from fat		
43	41% less calories	serving size 1/8	1/4 cup oil
44		calories 321	4 cup chopped cooked chicken
45		fat g 15.4	1 large green pepper
46	Example #3	total/carb g 54.2(37.7)	1 large red pepper
47	A.	sugar g 1.53	1 large onion
48		starch g	1 cup water
49	Apple Pie/regular	other g 8.43	2 tsp chicken bouillon
50		dietary	13 oz can pineapple chunks in
51	2 whole pie crusts	fiber g 8.1	juice (unsweetened)
52	3/4 cup granulated sugar		2 tbsp soy sauce
53	1/4 cup flour	4% of total calories from sugar	2 tbsp cornstarch
54	1/2 tsp nutmeg	43% of total calories	1/4 cup vinegar
55	1 tsp cinnamon	from fat	1/2 cup brown sugar

1	Nutritional Information
2	Serving size 1/4
3	calories 582
4	fat g 26.3
5	total/carb g (43.5)
6	sugar g 25
7	starch g
8	other g
9	dietary
10	fiber g
11	
12	17% of total calories from sugar
13	40% of total calories
14	from fat
15	
16	B.
17	
18	Sweet & Sour Chicken/Formula
19	1
20	sugar substitute
21	
22	1/4 cup oil
23	4 cup chopped cooked chicken
24	1 large green pepper
25	1 large red pepper
26	1 large onion
27	1 cup water
28	2 tsp chicken bouillon
29	13 oz can pineapple chunks in
30	juice (unsweetened)
31	2 tbsp soy sauce
32	2 tbsp cornstarch
33	1/4 cup vinegar
34	1/2 cup Formula 1
35	sugar substitute
36	1/2 tsp brown sugar
37	flavoring
38	
39	
40	Nutritional Information
41	Serving size 1/4
42	calories 532
43	fat g 26.3
44	total/carb g 50(27.83)
45	sugar g 2.07
46	starch g
47	other g 11.37
48	dietary
49	fiber g 10.8
50	1.5% of total calories from sugar
51	44% of total calories
52	from fat
53	8.5% Less calories
54	
55	C.

## Sweet &amp; Sour Chicken/Formula

1	sugar substitute/low fat
	1/4 cup fat substitute
	4 cup chopped cooked chicken
	1 large green pepper
	1 large red pepper
	1 large onion
	1 cup water
	2 tsp chicken bouillon
	13 oz can pineapple chunks in
	juice (unsweetened)
	2 tbsp soy sauce
	2 tbsp cornstarch
	1/4 cup vinegar
	1/2 cup Formula 1
	sugar substitute
	1/2 tsp brown sugar
	flavoring

## Nutritional Information

Serving size	1/4
calories	293
fat g	2.2
total/carb g	53(30.83)
sugar g	2.07
starch g	
other g	11.37
dietary	
fiber g	10.8
2.8% of total calories from sugar	
7% of total calories	
from fat	
50% Less calories	

## Example #5

A.

## Ranger Cookies/regular

1/2 cup margarine
2 large eggs
1/2 cup granulated sugar
1/2 cup brown sugar,
packed
1 cup all-purpose flour
1/2 tsp baking powder
1/2 tsp baking soda
1/4 tsp salt
1 cup oats
1 cup corn flakes
1/4 cup coconut flakes

## Nutritional Information

Serving size	1/36
calories	75
fat g	3.1
total/carb g	10
sugar g	5.5
starch g	
other g	
dietary	
fiber g	.3
40% of total calories from sugar	
38% of total calories	
from fat	

B.

Ranger Cookies/Formula 1  
Sugar Substitute

1/2 cup margarine
2 large eggs
1/2 cup Formula 1 sugar
substitute
1/2 cup Formula 1 sugar
substitute
1/2 tsp brown sugar flavoring
1 cup all-purpose flour
1/2 tsp baking powder
1/2 tsp baking soda
1/4 tsp salt
1 cup oats
1 cup corn flakes
1/4 cup coconut flakes

## Nutritional Information

Serving size	1/36
calories	63
fat g	3.1
total/carb g	9.9(4.98)
sugar g	.46
starch g	
other g	2.52
dietary	
fiber g	2.4

3% of total calories from sugar
44% of total calories
from fat
16% less calories



1	C.	calories	70	substitute
2		fat g	3.3	3 1/2 cups all-purpose flour
3	Ranger Cookies/Formula 1	total/carb g	9	1 tsp baking powder
4	Sugar Substitute/low fat	sugar g	3.3	1 tsp baking soda
5		starch g		1 tsp salt
6	1/2 cup low fat butter	other g		2 tsp vanilla
7	replacement	dietary		1/2 cup milk
8	2 large eggs	fiber g		
9	1/2 cup Formula 1 sugar			
10	substitute	19% of total calories from sugar		Nutritional Information
11	1/2 cup Formula 1 sugar	43% of total calories		Serving size 1/60
12	substitute	from fat		calories 44.5
13	1/2 tsp brown sugar flavoring			fat g .3
14	1 cup all-purpose flour	B.		total/carb g 10.8(7.86)
15	1/2 tsp baking powder			sugar g .28
16	1/2 tsp baking soda	Sugar Cookies/Formula 1A sugar		starch g
17	1/4 tsp salt	substitute		other g 1.5
18	1 cup oats			dietary
19	1 cup corn flakes	1 cup butter		fiber g 1.44
20	1/4 cup coconut flakes	2 large eggs		
21		1 cup Formula 1A sugar		3% of total calories from sugar
22	Nutritional Information	substitute		6% of total calories
23	Serving size 1/36	3 1/2 cups all-purpose flour		from fat
24	calories 47	1 tsp baking powder		36% less calories
25	fat g .5	1 tsp baking soda		
26	total/carb g 11.4(6.48)	1 tsp salt		
27	sugar g .46	2 tsp vanilla		Example #7
28	starch g	1/2 cup milk		A.
29	other g 2.52			
30	dietary			Sugar Cookie Frosting/regular
31	fiber g 2.4			
32		Nutritional Information		1/4 cup butter
33	4% of total calories from sugar	Serving size 1/60		2 cups powdered sugar
34	10% of total calories	calories 63		2 tbsp milk
35	from fat	fat g 3.4		1 tsp vanilla
36	37% less calories	total/carb g 8.9(46)		
37		sugar g .28		Nutritional Information
38		starch g		Serving size 1/48
39	Example #6	other g 1.5		calories 28
40	A.	dietary		fat g 1
41		fiber g 1.44		total/carb g 5
42	Sugar Cookies/regular			sugar g 5
43		2% of total calories from sugar		starch g
44	1 cup butter	47% of total calories		other g
45	2 large eggs	from fat		dietary
46	1 cup granulated sugar	10% less calories		fiber g
47	3 1/2 cups all-purpose flour			
48	1 tsp baking powder	C.		71% of total calories from sugar
49	1 tsp baking soda			32% of total calories
50	1 tsp salt	Sugar Cookies/Formula 1A sugar		from fat
51	2 tsp vanilla	substitute/low fat		
52	1/2 cup milk			B.
53		1 cup low fat butter replacement		
54	Nutritional Information	2 large eggs		Sugar Cookie Frosting/Formula
55	Serving size 1/60	1 cup Formula 1A sugar		1A

1 sugar substitute  
 2  
 3 1/4 cup butter  
 4 2 cups Formula 1A powdered  
 5 sugar substitute  
 6 2 tbsp milk  
 7 1 tsp vanilla  
 8  
 9  
 10 Nutritional Information  
 11 Serving size 1/48  
 12 calories 23  
 13 fat g 1  
 14 total/carb g 8(3.59)  
 15 sugar g .41  
 16 starch g  
 17 other g 2.25  
 18 dietary  
 19 fiber g 2.16  
 20  
 21 7% of total calories from sugar  
 22 32% of total calories  
 23 from fat  
 24 18% less calories  
 25  
 26 C.  
 27  
 28 Sugar Cookie Frosting/Formula  
 29 1A  
 30 sugar substitute/low fat  
 31  
 32 1/4 cup low fat butter  
 33 replacement  
 34 2 cups Formula 1A powdered  
 35 sugar substitute  
 36 2 tbsp milk  
 37 1 tsp vanilla  
 38  
 39 Nutritional Information  
 40 Serving size 1/48  
 41 calories 18  
 42 fat g .1  
 43 total/carb g 9(4.59)  
 44 sugar g .41  
 45 starch g  
 46 other g 2.25  
 47 dietary  
 48 fiber g 2.16  
 49  
 50 9% of total calories from sugar  
 51 5% of total calories  
 52 from fat  
 53 35% less calories  
 54  
 55

Example #8  
 A.  
 Oatmeal Cake and Coconut  
 Topping/regular  
 1/2 cup margarine  
 1 cup brown sugar  
 1 cup granulated sugar  
 2 large eggs  
 1 cup oats, quick  
 1 1/2 cup boiling water  
 1 1/2 cup all purpose flour  
 1/2 tsp salt  
 1 tsp vanilla  
 1 tsp cinnamon  
 1 tsp baking soda  
 1/4 cup margarine  
 2 tbsp milk  
 1 cup brown sugar  
 2 tbsp chopped nuts  
 1/4 cup coconut  
 Nutritional Information  
 Serving size 1/15  
 calories 294  
 fat g 11.3  
 total/carb g 46  
 sugar g 26  
 starch g  
 other g  
 dietary  
 fiber g  
 35% of total calories from sugar  
 34% of total calories  
 from fat  
 B.  
 Oatmeal Cake and Coconut  
 Topping/ Formula 1A s/sub.  
 1/2 cup margarine  
 1 cup Formula 1A s/sub.  
 1 tsp brown sugar flavoring  
 1 cup Formula 1A s/sub.  
 2 large eggs  
 1 cup oats, quick  
 1 1/2 cup boiling water  
 1 1/2 cup flour  
 1/2 tsp salt  
 1 tsp vanilla

1 tsp cinnamon  
 1 tsp baking soda  
 1/4 cup margarine  
 2 tbsp milk  
 1 cup Formula 1A s/sub.  
 1 tsp brown sugar flavoring  
 2 tbsp chopped nuts  
 1/4 cup coconut  
 Nutritional Information  
 Serving size 1/15  
 calories 237  
 fat g 11.3  
 total/carb g 52.5(28.98)  
 sugar g 2.4  
 starch g  
 other g 12  
 dietary  
 fiber g 11.52  
 4% of total calories from sugar  
 43% of total calories  
 from fat  
 19% less calories  
 C.  
 Oatmeal Cake and Coconut  
 Topping/ Formula 1A sugar/low  
 fat  
 1/2 cup lowfat butter/sub.  
 1 cup Formula 1A s/sub.  
 1 tsp brown sugar flavoring  
 1 cup Formula 1A s/sub.  
 2 large eggs  
 1 cup oats, quick  
 1 1/2 cup boiling water  
 1 1/2 cup flour  
 1/2 tsp salt  
 1 tsp vanilla  
 1 tsp cinnamon  
 1 tsp baking soda  
 1/4 cup margarine  
 2 tbsp milk  
 1 cup Formula 1A s/sub.  
 1 tsp brown sugar flavoring  
 2 tbsp chopped nuts  
 1/4 cup coconut  
 Nutritional Information  
 Serving size 1/15

1 calories 196  
 2 fat g .9  
 3 total/carb g 55(31.48)  
 4 sugar g 2.4  
 5 starch g  
 6 other g 12  
 7 dietary  
 8 fiber g 11.52  
 9 5% of total calories from sugar  
 10 4% of total calories  
 11 from fat  
 12 33% less calories

**Example #9****A.****Caramel Popcorn/regular**

21 3/4 cup butter  
 22 3/4 cup brown sugar  
 23 3/4 cup granulated sugar  
 24 1/2 cup light corn syrup  
 25 1/4 tsp salt  
 26 1/2 cup water  
 27 1 tsp vinegar  
 28 10 cup popcorn, air-popped

**Nutritional Information**

32 Serving size 1/16  
 33 calories 185  
 34 fat g 8.8  
 35 total/carb g 28  
 36 sugar g 24  
 37 starch g  
 38 other g  
 39 dietary  
 40 fiber g

42 52% of total calories from sugar  
 43 43% of total calories  
 44 from fat

**B.****Caramel Popcorn/Formula 1  
sugar substitute/corn syrup sub**

51 3/4 cup butter  
 52 3/4 cup Formula 1 sugar  
 53 substitute  
 54 3/4 tsp brown sugar flavoring

3/4 cup Formula 1 sugar  
 substitute  
 1/2 cup corn syrup substitute  
 1/4 tsp salt  
 1/2 cup water  
 1 tsp vinegar  
 10 cup popcorn, air-popped

**Nutritional Information**

Serving size 1/16  
 calories 161  
 fat g 8.8  
 total/carb g 28(11.37)  
 sugar g 2.2  
 starch g  
 other g 8.53  
 dietary  
 fiber g 8.1

5% of total calories from sugar  
 49% of total calories  
 from fat  
 13% less calories

**C.****Caramel Popcorn/Formula 1  
sugar substitute/corn syrup  
sub/low fat**

3/4 cup low fat butter  
 replacement  
 3/4 cup Formula 1 sugar  
 substitute  
 3/4 tsp brown sugar flavoring  
 3/4 cup Formula 1 sugar  
 substitute  
 1/2 cup corn syrup substitute  
 1/4 tsp salt  
 1/2 cup water  
 1 tsp vinegar  
 10 cup popcorn, air-popped

**Nutritional Information**

Serving size 1/16  
 calories 113  
 fat g .8  
 total/carb g 35(18.37)  
 sugar g 2.2  
 starch g  
 other g 8.53  
 dietary  
 fiber g 8.1

9% of total calories from sugar  
 7% of total calories  
 from fat  
 47% less calories

**Example #10****A.****Tangy Coleslaw/regular**

1 tbsp butter  
 2 tbsp flour  
 4 tbsp granulated sugar  
 1/4 tsp pepper  
 2 tbsp dijon mustard  
 1 1/2 cup chicken broth  
 1/2 cup vinegar  
 8 cups shredded cabbage  
 1/2 cup chopped onion

**Nutritional Information**

Serving size 1/9  
 calories 75  
 fat g 2.1  
 total/carb g 12  
 sugar g 5.5  
 starch g  
 other g  
 dietary  
 fiber g

29% of total calories from sugar  
 25% of total calories  
 from fat

**B.****Tangy Coleslaw/Formula 1A  
sugar substitute**

1 tbsp butter  
 2 tbsp flour  
 4 tbsp Formula 1A sugar  
 substitute  
 1/4 tsp pepper  
 2 tbsp dijon mustard  
 1 1/2 cup chicken broth  
 1/2 cup vinegar  
 8 cups shredded cabbage  
 1/2 cup chopped onion

1 Nutritional Information  
 2 Serving size 1/9  
 3 calories 63  
 4 fat g 2.1  
 5 total/carb g 12(7.1)  
 6 sugar g .46  
 7 starch g  
 8 other g 2.5  
 9 dietary  
 10 fiber g 2.4  
 11  
 12 3% of total calories from sugar  
 13 29% of total calories  
 14 from fat  
 15 16% less calories  
 16  
 17 C.  
 18  
 19 Tangy Coleslaw/Formula 1A  
 20 sugar substitute/low fat  
 21  
 22 1 tbsp low fat butter substitute  
 23 2 tbsp flour  
 24 4 tbsp Formula 1A sugar  
 25 substitute  
 26 1/4 tsp pepper  
 27 2 tbsp dijon mustard  
 28 1 1/2 cup chicken broth  
 29 1/2 cup vinegar  
 30 8 cups shredded cabbage  
 31 1/2 cup chopped onion  
 32  
 33  
 34 Nutritional Information  
 35 Serving size 1/9  
 36 calories 57  
 37 fat g .2  
 38 total/carb g 13(8.1)  
 39 sugar g .46  
 40 starch g  
 41 other g 2.5  
 42 dietary  
 43 fiber g 2.4  
 44  
 45 3% of total calories from sugar  
 46 3% of total calories  
 47 from fat  
 48 24% less calories  
 49  
 50  
 51  
 52 Example #11  
 53 A.  
 54  
 55 Brown Sugared Carrots/regular

1/4 cup butter  
 1/2 cup brown sugar, packed  
 1 pound carrots  
 Nutritional Information  
 Serving size 1/4  
 calories 247  
 fat g 11.6  
 total/carb g 37  
 sugar g 25  
 starch g  
 other g  
 dietary  
 fiber g  
 40% of total calories from sugar  
 42% of total calories  
 from fat  
 B.  
 Brown Sugared Carrots/  
 Formula 1 sugar substitute  
 1/4 cup butter  
 1/2 cup Formula 1 sugar  
 substitute  
 1/2 tsp brown sugar flavoring  
 1 pound carrots  
 Nutritional Information  
 Serving size 1/4  
 calories 191  
 fat g 11.6  
 total/carb g 35(12.83)  
 sugar g 2  
 starch g  
 other g 11.37  
 dietary  
 fiber g 10.8  
 4% of total calories from sugar  
 54% of total calories  
 from fat  
 23% less calories  
 C.  
 Brown Sugared Carrots/  
 Formula 1 sugar substitute/low  
 fat

1/4 cup low fat butter  
 replacement  
 1/2 cup Formula 1 sugar  
 substitute  
 1/2 tsp brown sugar flavoring  
 1 pound carrots  
 Nutritional Information  
 Serving size 1/4  
 calories 135  
 fat g 1.1  
 total/carb g 43(20.83)  
 sugar g 2  
 starch g  
 other g 11.37  
 dietary  
 fiber g 10.8  
 6% of total calories from sugar  
 7% of total calories  
 from fat  
 45% less calories  
 Example #12  
 A.  
 lemonade/regular  
 3 cups water  
 1 cup lemon juice(about 4  
 lemons)  
 1/2 cup granulated sugar  
 Nutritional Information  
 Serving size 1/4  
 calories 112  
 fat g 0  
 total/carb g 30  
 sugar g 25  
 starch g  
 other g  
 dietary  
 fiber g  
 89% of total calories from sugar  
 0% of total calories  
 from fat  
 B.

1     **lemonade/Formula 1**  
2     **sugar substitute**  
3  
4     **3 cups water**  
5     **1 cup lemon juice(about 4**  
6     **lemons)**  
7     **1/2 cup Formula 1 sugar**  
8     **substitute**  
9  
10  
11    **Nutritional Information**  
12    **Serving size     1/4**  
13    **calories         63**  
14    **fat g            0**  
15    **total/carb g     30(7.83)**  
16    **sugar g          2**  
17    **starch g**  
18    **other g          11.37**  
19    **dietary**  
20    **fiber g          10.8**  
21  
22    **13% of total calories from sugar**  
23    **0% of total calories**  
24    **from fat**  
25

26           While the present invention is described by reference to specific embodiments, it  
27    will be apparent that other alternative embodiments and methods of implementation or  
28    modification may be employed without departing from the true spirit and scope of the  
29    invention.

## 1 WHAT IS CLAIMED IS:

- 2 1. A low calorie, diabetic safe, water soluble, synergistic sweetening composition  
3 in whole as a one-to-one for granulated sugars, brown sugars, and powdered  
4 sugars for sweetening ingestible food, the composition comprising:
- 5 (a) one or more intense sweeteners at a level from about 0.001 to about  
6 8% by weight of the composition;
- 7 (b) two or more bulk sweeteners as at a level from about 0.5 to about 99%  
8 by weight of the composition;
- 9 (c) one or more sweeteners present in the present invention at a level from  
10 about 1 to about 15% by weight of the composition;
- 11 (d) one or more anti-flatulent agents at a level from about .001 to about  
12 5% by weight of the composition;
- 13 (e) one or more flavoring agents at a level from about .0001 to about 5 by  
14 weight of the composition.

- 1 2. The composition of claim 1 wherein the intense sweeteners are selected from  
2 the group consisting of aspartame, acesulfame-K, thaumatin, talin, arabic gum,  
3 saccharin, cyclamate, stevioside, glycyrrhizin, dihydrochalcones, monellin,  
4 chlorodeoxygalactosucrose derivatives, licorice extract, or mixtures thereof.

- 1 3. The composition of claim 1 wherein the bulk sweeteners are selected from the  
2 group consisting of the groups including inulin, branched inulin, linear fructo-  
3 oligosaccharides, branched fructo-oligosaccharides, lactitol, maltitol, mannitol,

4 sorbitol, erythritol, galactitol, isomaltulose, polyglucose, polymaltose,  
5 carboxymethylcellulose, carboxyethylcellulose, arabinogalactan,  
6 microcrystalline cellulose, polydextrose, palatinit, indigestible dextrins, or  
7 mixtures thereof.

1 4. The composition of claim 3 wherein one of the bulk sweeteners is inulin.

1 5. The composition of claim 3 wherein the bulk sweeteners are crystallized,  
2 granulated, powdered, or mixtures thereof.

1 6. The composition of claim 1 wherein the sweeteners are selected from the  
2 group consisting of fructose, glucose, sucrose, and mixtures thereof.

1 7. The composition of claim 6 wherein the sweeteners are crystalline, powdered,  
2 or mixtures thereof.

1 8. The composition of claim 1 wherein the anti-flatulent agents are selected from  
2 the group consisting of lactobacillus acidophilus culture, yucca schidigera  
3 extract, simethicone, or mixtures thereof.

1 9. The composition of claim 1 wherein the flavoring agent is ethyl malto.



- 1        10.    The composition of claim 1 wherein synergistic sweetening composition is a  
2                    one-to-one substitution for brown sugars.
- 1        11.    The composition of claim 10 wherein said flavoring agents are natural brown  
2                    sugar and molasses flavoring or mixtures thereof.
- 1        12.    The composition of claim 11 wherein the brown sugar molasses flavoring, or  
2                    mixture thereof is used to replace brown sugars in ingestible food  
3                    compositions.
- 1        13.    The composition of claim 1 wherein the synergistic sweetening composition is  
2                    in whole a one-to-one substitute for powdered sugars.
- 1        14.    The composition of claim 15 wherein the bulk sweeteners are powdered.
- 1        15.    The composition of claim 15 wherein the sweeteners are powdered.
- 1        16.    The composition of claim 1 wherein the caloric content is at least one half the  
2                    calories of sucrose.
- 1        17.    The composition of claim 1 is in whole a one-to-one substitution for sugar by  
2                    volume measurement and by weight measurements.

1           18.    The composition of claim 21 wherein the ingestible foods include beverages,  
2                   confectioneries, chocolates and candies; bakery products; main dishes, side  
3                   dishes, and soups; desserts; pharmaceutical products; salad dressings; frozen  
4                   confectionery products; dairy products; oral hygiene products; jams and jellies;  
5                   but not limited thereof.

1           19.    a method for manufacturing a synergistic sweetening composition comprising:

- 2                   (a)    preparing a diluted mixture of intense sweeteners and water at a  
3                            correct strength needed for the composition;  
4                   (b)    spraying the diluted mixture over bulk sweeteners;  
5                   (c)    drying the above mixture;  
6                   (d)    mixing the bulk sweeteners and intense sweeteners in a drum mixer for  
7                            about 20 minutes until completely dispersed;  
8                   (e)    adding the intense sweeteners, adding the flavor enhancer, and the anti-  
9                            flatulent agent to the bulk sweeteners and intense sweeteners and  
10                           mixing until completely dispersed;  
11                  (f)    pouring the finished mixture into air-tight packaging and sealing.

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US97/13526

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :A23L 1/236

US CL :426/548

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 426/548, 061, 658

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2,629,665 A (GORDON) 24 February 1953, entire document.	1-19
Y	US 4,001,456 A (GLICKSMAN ET AL) 04 January 1977, entire document.	1-19
Y	US 5,064,658 A (CHERUKURI ET AL) 12 November 1991, entire document.	1-19

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
*A* document defining the general state of the art which is not considered to be of particular relevance	*X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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*O* document referring to an oral disclosure, use, exhibition or other means	
*P* document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

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